CALIFORNIA DIVISION OF MINES AND GEOLOGY

FAULT EVALUATION REPORT

FER-119

March 31, 1981

1. Name of fault.

Serra fault.

2. Location of fault.

Northern San Mateo County, in the San Francisco South and Montara Mountain 7.5-minute quadrangles (see Figure 1).

3. Reason for evaluation.

This report is completed as part of a ten-year program to evaluate and zone active faults (see Hart, 1980). The Serra fault was originally zoned for Special Studies in 1974 (see Figures 2A and 2B).

4. References.

Berlogar, Long, and Associates, 1975a, Engineering geologic investigation at the southwest corner of Vista Grande and Colorados Drive, Millbrae, California: Unpublished consulting report filed with the City of Millbrae (AP#162).

————————, 1975b, Engineering geologic investigation, Lot #16, Block #10, Silva Ranch Subdivision 2A, Millbrae, California: Unpublished consulting report filed with the City of Millbrae (AP#164).

————————, 1975c, Engineering geologic investigation, Lot #83, Millbrae Highlands No. 10, Millbrae, California: Unpublished consulting report filed with the City of Millbrae (AP#165).

————————, 1978, Geotechnical investigation, subdivision of Lot No. 78, Millbrae Meadows No. 3, Parcel No. 021-023-090, Millbrae, California: Unpublished consulting report filed with the City of Millbrae (AP#829).

Bonilla, M.G., 1971, Preliminary geologic map of the San Francisco South quadrangle and part of the Hunters Point quadrangle, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-311.

Note: Numbers in parentheses refer to CDMG file numbers. AP#__ refers to report in the Alquist-Priolo file; C#___ refers to report in the informal consulting report file. Both of these files are currently in the San Francisco District Office.

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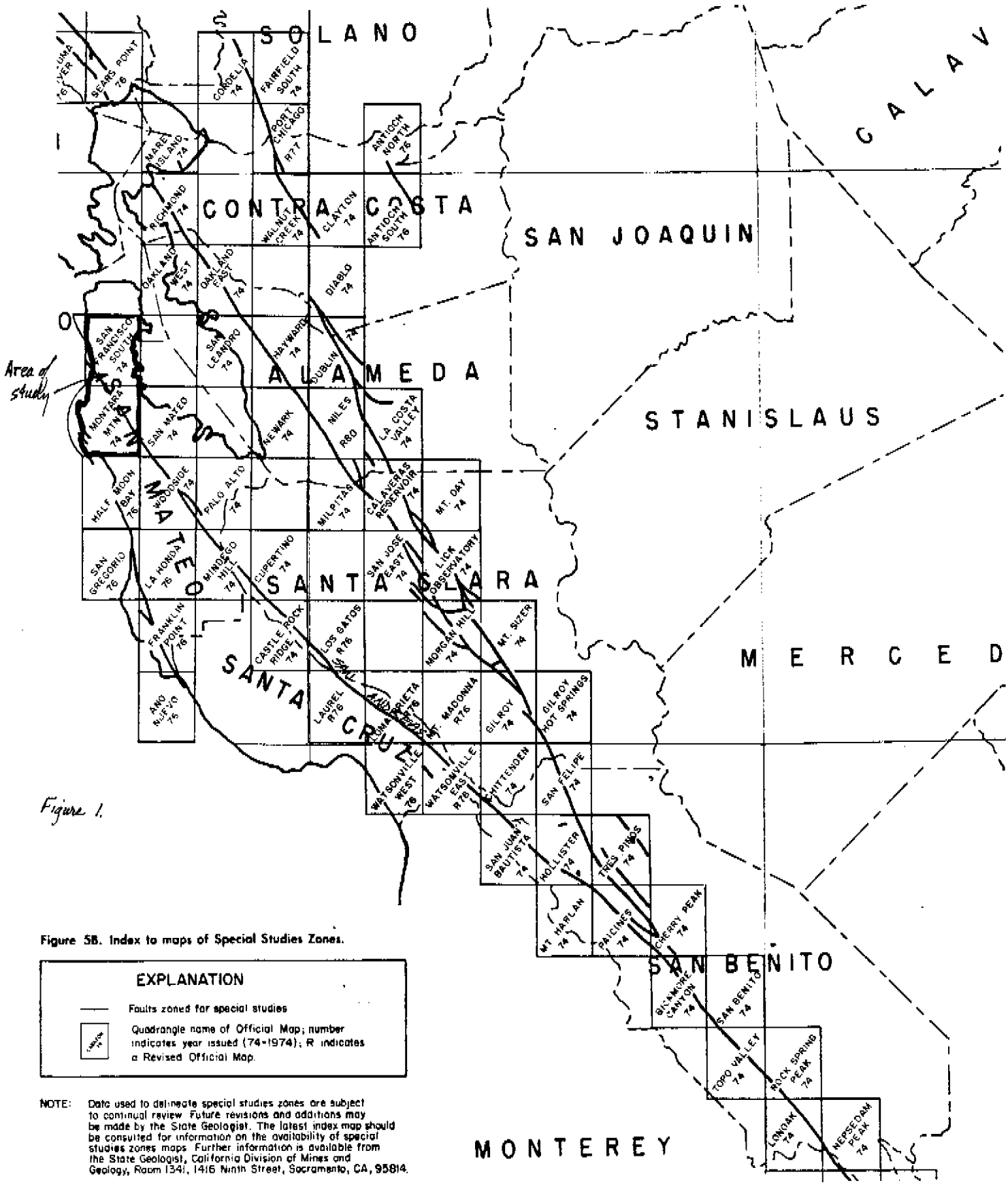

Figure 1.

Figure 5B. Index to maps of Special Studies Zones.

EXPLANATION

Faults zoned for special studies

Quadrangle name of Official Map; number indicates year issued (74=1974); R indicates a Revised Official Map.

NOTE: Data used to delineate special studies zones are subject to continual review. Future revisions and additions may be made by the State Geologist. The latest index map should be consulted for information on the availability of special studies zones maps. Further information is available from the State Geologist, California Division of Mines and Geology, Room 1341, 1416 Ninth Street, Sacramento, CA, 95814.

Scale 1:1,000,000

1 inch equals approximately 16 miles

Brabb, E.E., and E.H. Pampeyan, 1972, Preliminary geologic map of San Mateo County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-328.

Brown, R.D., Jr., 1972, Active faults, probable active faults, and associated fracture zones, San Mateo County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-355.

California Division of Mines and Geology, 1974a, Official map of Special Studies Zones, Montara Mountain quadrangle.

_____, 1974b, Official map of Special Studies Zones, San Francisco South quadrangle.

Crosby, Jo, and Associates, 1975, Geological investigation, Lot 1, Block 16, Silva Ranch 2B, El Capitan and Clearfield Drive, Millbrae, California: Unpublished consulting report filed with the City of Millbrae (AP#163).

Donley, Howard F., and Associates, 1975, Geotechnical study, geologic fault hazard zone, City of Burlingame: Unpublished consulting report for the City of Burlingame (C#398).

Ellen, Stephen, C.M. Wentworth, E.E. Brabb, and E.H. Pampeyan, 1972, Description of geologic map units, San Mateo County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-328.

Hart, E.W., 1980, Fault rupture Hazard zones in California: California Division of Mines and Geology Special Publication 42.

JCP-Engineers and Geologists, 1980, Geologic and soil & foundation studies for one homesite on Montecito Way, Burlingame, California: Unpublished consulting report filed with the City of Burlingame (AP#1228).

JCP-Geologists, 1977 Engineering geologic study for proposed apartment building, San Bruno, California: Unpublished consulting report filed with the City of San Bruno (AP#641).

_____, 1978, Engineering geologic study for proposed restaurant on Crestwood Drive, San Bruno, California: Unpublished consulting report filed with the City of San Bruno (AP#912).

Jones, William F., Inc., 1977, A geotechnical investigation for Lots 69, 70, and 71, Millbrae Highlands No. 10, Millbrae, California: Unpublished consulting report filed with the City of Millbrae (AP#539).

Meyer, C.E., M.J. Woodward, A.M. Sarna-Wojcicki, and C.W. Naeser, 1980, Zircon fission-track age of 0.45 million years on ash in the type section of the Merced Formation, west-central California: U.S. Geological Survey Open-File Report 80-1071.

Pampeyan, E.H., 1979, Preliminary map showing recency of faulting in coastal north-central California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1070.

Purcell, Rhoades, and Associates, 1976, Geologic investigation, Lots 16 and 17, Block 72, La Prenda Drive, Millbrae, California: Unpublished consulting report filed with the City of Millbrae (AP#185).

Fairchild, 1941, Black and white aerial photographs, flight 6660, numbers 27 to 31, and 65 to 68, approximate scale 1:14,000.

Real, C., p.c., Earthquake epicenters 1900-1974: San Francisco sheet: California Division of Mines and Geology, Unpublished data on file in San Francisco District Office.

Rhoades, Daniel J., and Associates, 1975, Foundation engineering and engineering geology investigation, Lot 5, Block 34, Mills Estates No. 20, Millbrae, California: Unpublished consulting report filed with the City of Millbrae (AP#161).

Rowland, R.E., 1976, Geologic report on Goos property, 6 La Solano, Millbrae, California: Unpublished consulting report filed with the City of Millbrae (AP#184).

Wood, P.R., 1979, Geologic reconnaissance, Lot 9-B, between Aura Vista and El Bonita Way, Millbrae, California: Unpublished consulting report filed with the City of Millbrae (AP#1052).

5. Summary of available information.

The Serra fault (a west-dipping thrust fault) was originally zoned by the State Geologist in 1974 (California Division of Mines and Geology 1974a; 1974b). Information in the plan-file indicates that these two maps were compiled by C.F. Armstrong based on Bonilla (1971), Brown (1972), and Brabb and Pampeyan (1972). Furthermore, Armstrong's compilations note that the Serra fault cuts deposits of Quaternary age. At the time the original SSZ maps were issued, such faults were zoned as potentially active faults. Since the original maps were issued, the policies and criteria concerning the Alquist-Priolo Act have been modified such that only those faults which are sufficiently active (Holocene) and well-defined are now zoned (Hart, 1980). Thus, removal of the SSZ around the Serra fault may be warranted if evidence of Holocene fault movement is lacking.

The youngest unit that any reference identifies as being cut by the Serra fault is the Colma Formation, late Pleistocene in age (Brabb and

Pampeyan, 1972; Ellen, et al, 1972; and, Pampeyan, 1979). The Merced Formation is shown to be offset in many places, with Franciscan bedrock thrust over Merced. Meyer, et al(1980), has dated the type Merced as about 0.45 million years old, but the age of the unit (basal Merced) in the location of the Serra fault is not known with certainty. The Colma Formation is generally believed to be younger than the type Merced. Exposures observed during this investigation indicate this thrust has had displacement in excess of about 5 meters along it (apparent dip slip). No detailed stratigraphic investigations have been conducted along this imbricate thrust zone which would enable an accurate estimate of the cumulative displacement to be made.

Several consulting reports have been completed in the vicinity of the Serra fault, and the fault has been located in several of these investigations. The results of these studies are summarized in Table 1. None of these reports document the relationship of the fault relative to units younger than the Colma Formation, with the exceptions of one report which depicts an alluvial deposit as not being affected by the fault (Purcell, Rhoades, and Associates, 1976, AP#185). (And, I question whether this deposit was indeed alluvial or colluvial, based largely on the steepness of the slope trenched). In any case, the age of this deposit has not been established.

Neither do any of the available reports recognize topographic features indicative of Holocene faulting. Based on a similar analysis, Pampeyan (1979) concluded that the Serra fault can only be demonstrated as having movement along it during the last 700,000 years (late Quaternary) — Holocene movement cannot be demonstrated.

6. Air photo interpretation; field investigations.

Fairchild (1941) air photos were interpreted specifically for the purpose of detecting any evidence of Holocene thrust faulting. In general, the Serra fault is mapped along a broad, northeast-facing hillfront. This broad hillfront could conceivably be a remnant fault scarp, and is rather

dissected indicating it is considerably older than Holocene in age. No well-defined features indicative of Holocene fault movement were detected anywhere along or near the mapped traces of the Serra fault.

A rapid field reconnaissance was also made along the fault. Numerous exposures of highly sheared Franciscan material were noted in the proximity of the traces shown on the Special Studies Zones maps. In one location, Franciscan has clearly overthrust younger material (probably Merced Formation) (see Figure 2A). And, the mapping of outcrops permitted me to (1) follow, in general, the assumed main trace of the Serra fault (that which juxtapsoses Franciscan with younger material). Nowhere was any exposure noted in which the fault-soil relationship could be observed.

7. Seismicity.

Numerous epicenters were recorded in the vicinity of the Serra fault between 1900 and 1974 (Real, p.c.). However, because of the proximity of the Serra fault to the San Andreas, one cannot say with any certainty that these events were produced by movement along the Serra fault at depth. Indeed, the most likely source for these epicenters is the San Andreas fault.

8. Conclusions.

Movement along the Serra fault during late Quaternary time has been demonstrated by virtue of faulted Merced deposits, and the fault was originally zoned on this basis. However,neither this investigator nor any other investigator has produced any evidence to support Holocene activity along the Serra fault. Similarly, no evidence has been found that would conclusively demonstrate that the fault has not been active during the Holocene. The absence of narrow scarps similar to those found along the Ventura and similar faults is suggestive that the fault is not sufficiently active (Holocene) to warrant a zoning. The nearby San Andreas fault is the

most likely source of the recorded earthquakes; however it is not inconceivable that earthquakes have occurred along the Serra fault in recent time.

The highly sheared nature of the Franciscan material along the fault zone would tend to make locating the most recently active trace difficult. In some places, one can detect a trace that has has movement along it during the Quaternary by virtue of the presence of the Merced Formation. However, one cannot state with any certainty that this trace is or is not the trace along which the most recent movement has occurred.

9. Recommendations.

Although conclusive evidence that the Serra fault has not had movement occur along it during Holocene time is lacking, there is also no evidence to support Holocene movement along the fault. Therefore, the fault would not be considered active under the present zoning criteria (see Hart, 1980), and it is appropriate to remove the traces of the Serra fault from the Special Studies Zones maps. The removal of these SSZ's are, therefore, recommended.

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March 31, 1981

TCS/jab

I agree with the recommendations.
EHA
4/13/81

Table 1. Summary of results of site-specific investigations by consulting geologists.

File #	Consultant	Trenching	Other Methods*	Active Fault Found	Comments
AP #161	Rhoades & Assoc	No	L, T, B, R		Thrust fault cutting Merced found. Setback.
AP# 162	Berlogar, Long & Assoc	No	A, L, R	No	
AP# 163	Crosby & Assoc	No	A, L, R	No	
AP# 164	Berlogar, Long & Assoc	No	A, L, R	No	
AP# 165	Berlogar, Long & Assoc	No	A. L. R	No	
AP# 184	Rowland	Yes	A, L, R	No	
AP# 185	Purcell, Rhoades & Assoc	Yes	A, L, R		Faults identified as active based on the presence of gypsum. Setbacks. Fault/ soil relationship not obs.
AP# 539	W.F. Jones, Inc	No	L, R, SR	No	
AP# 641	JCP-Geologists	No	A, L, R	No	
AP# 829	Berlogar, Long & Assoc	No	T, L, R, A	No	
AP# 912	JCP-Geologists	No	A, L, R	No	
AP# 1052	Wood	No	R, B	No	
AP# 1228	JCP-Engineers & Geologists	Yes	T, A, L, R	No	Setbacks established along "potentially active faults".
C# 398	H.F. Donley & Assoc	No	A, M, R		Potentially active faults mapped

* A: Aerial photo interpretation; T: Test pits; L: Literature review; R: Reconnaissance mapping; SR: Seismic refraction; B: Bore hole correlation; M: Magnetometer surveys.

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Figure 3. Air photo interpretation.
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STATE OF CALIFORNIA
GOODWIN J. KNIGHT, GOVERNOR
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MONTARA MOUNTAIN QUADRANGLE
CALIFORNIA—SAN MATEO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

Symbols used along Serra fault.
t = tonal
break in slope
cb = closed depression
b = bench